

AIR COMMAND AND STAFF COLLEGE

AIR UNIVERSITY

**LEVERAGING TESTING AND TRAINING SYNERGIES IN
NATO EXERCISES**

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ABSTRACT

The goal of the North Atlantic Treaty Organization's (NATO) Connected Forces Initiative (CFI) is to optimize the ability of NATO forces to operate together, through technical interoperability and multi-national training. While the CFI seeks to achieve cross-national efficiencies, the functional communities within the member-nation militaries generally focus in improving their internal efficiencies, rather than considering opportunities to obtain cross functional efficiencies. In some cases, this is due to cultural differences that define the decision-making drivers and values of the two communities. The primacy of prioritization in the operational training community, versus Cost-As-An-Independent-Variable (CAIV) in the testing community, and the preference for complete control by both groups are identified as major challenge to conducting integrated activities. Using the Best Value contracting model as precedence, this paper proposes a decision-support model that applies a marginal-cost comparison approach to a System-of-Systems-Analysis (SOSA) to package costs and benefits into a value-judgment decision framework to support decision-making for integrated testing and training events. The certification of multi-national receiver for air-refueling is used as an example case.

Introduction

The North Atlantic Treaty Organization's (NATO) International Security Assistance Force (ISAF) mission in Afghanistan is projected to end after 2014. At the conclusion of this mission, NATO expects to shift its focus from current operations to operational readiness. The Connected Forces Initiative (CFI) is one of the policy constructs that implements this change in focus. The CFI calls for NATO members to, "ensure that Allies can communicate, train and operate together effectively, and that NATO has increasing opportunities to validate and certify their ability to do so."¹

At the national-level, the CFI's objective of enhancing the effectiveness of international forces translates into reduced defense burdens for the individual member states. However, at the military/defense department-level, every aspect of the CFI comes with a cost. Effectively operating together requires interoperable weapon- and training-systems, effective technical means of communication, and integrated training.² Whether the system is as complex as the Joint Strike Fighter or as simple as a standardized rifle-round, interoperable systems incur development, test, procurement, and sustainment costs.^{3,4} For many of the expansion-members of NATO, this represents a thorough and expensive refitting of their military equipment from Soviet-bloc standards to NATO standards. For example, Poland's armed forces modernization plan is projected to cost \$30-40 billion per year, for the next 10 years, to transition ships, helicopters, tanks, aircraft, personnel carriers, and air & missile defense systems to modern, NATO interoperable, systems.⁵ Communicating effectively may be even more challenging in the long run, because it has a material and a human component. NATO forces must have both technically interoperable, secure communications systems and personnel who are proficient at communicating, often in non-native languages, under the pressure of combat conditions. While

the technical gap can be closed within a generation of equipment updates, personnel must interact frequently to develop new personnel and maintain their proficiency.⁶ Finally, simply conducting military training is an expensive endeavor, largely due to the costs of energy. Dorothy Robyn, the Deputy Under Secretary of Defense for Installations & Environment, has identified the US Department of Defense as the nation's largest energy consumer, with over \$11 billion spent on operational energy, i.e. fuel for tanks, ships, planes, and generators, in 2011 alone.⁷ So, fulfilling the CFI's objective of increasing the opportunities to train, directly translates to increased costs.

However, the CFI is pressing for more resources at a time when the member governments of NATO are pushing for even lower defense expenditures. In response to the worst economic slump since the Second World War, governments are restricting or reducing their defense spending, some sharply.⁸ For example, between 2009 and 2011, the European NATO members cut \$45 billion from the defense expenditures.⁹ By the same token, the 2013 US budget is projected to be reduced by \$454 billion between 2013 and 2021.¹⁰ While emerging threats could reverse this trend, the general direction of defense spending is currently downward, and will likely remain that way for the foreseeable future.

Large government institutions, like defense departments, have a limited number of strategic-level options for moving forward with diminishing resources. First, they can reduce their capabilities, i.e. simply do less in order to live within the constraints. Second, they can spread their material investment out over a longer period. This reduces the annual costs of programs, but usually increases the total costs. Third, they can defer activities and programs in order to keep certain elements of their forces at full capability while allowing others to diminish. Finally, they can seek efficiencies within their existing programs in order to "do more, with

less.” Traditionally, this is the preferred approach of governments, because it is the easiest option politically.

It is taken as an assumption that NATO, in general, will pursue the fourth option in response to increasing budgetary pressure. In the natural flow of responsibility within bureaucracies, the task of actually finding efficiencies to implement the CFI, while simultaneously preserving capability, will fall to the military. Within the NATO construct, this makes the US dual-hatted Supreme Allied Commander Europe (SACEUR)/Commander, United States European Command (CDR USEUCOM) especially important, since the US currently contributes approximately 75-percent of NATO military expenditures.¹¹ Yet, he has only a limited range of options that are under his direct control. The balancing decision between development, procurement, and operations will be made at higher levels of the services, departments, and government. So, his attention will naturally fall upon the optimization of the operations under his direct control. However, while the bulk of the procurement community is not in a position to provide any form of synergy, there are certain situations where the testing community may be able to. As a result, there is an under-leveraged opportunity to increase overall efficiency and effectiveness, at the macro-level, by integrating testing and training events. But, this is only occasionally acted upon because it reduces the internal efficiency of each domain.

The prevailing communities-of-practice, in both disciplines, steer their members to a perspective that excludes impartial consideration of the net efficiencies that could be gained. The initial perspective of both groups is a client/service-provider model, wherein the client is trying to minimize his costs and the service provider is trying to maximize his “profit.” As a result, the entering operational perspective is usually that the test center should pay for

absolutely everything that is used, disrupted, leveraged, occupied, or expended for the test. Essentially, the testing organizations should pay for the complete opportunity cost of supporting the test, even if supporting the test is transparent to the assets involved, i.e. they would have been there anyway. Conversely, the Test Director will naturally only want to pay for the actual costs of the activities that were specifically required for their test to minimize his or her expenditures and preserve that funding for other activities. This is a natural position for both organizations to adopt, they are separate entities, with distinctly different responsibilities, and are both resource constrained. However, it is not a conducive mindset to explore opportunities to increase collective efficiency or effectiveness.

Before proceeding with the discussion of collective efficiency and effectiveness, it is necessary to distinguish the types of testing and training in question. Not all testing is appropriate for a training environment. The Measure-of-Performance (MOP) oriented activities of Developmental Testing and Evaluation (DT&E) must be performed in a completely controlled environment in order to isolate the independent and dependent variables. By the same token, the measures-of-Effectiveness (MOE) based Initial Operational Testing and Evaluation (OT&E) must be completed prior to the certification of training products, technical orders, and operations manuals which are necessary to produce Initial Qualification Training (IQT) programs. So, the tests in question are best characterized as US Major Command (MAJCOM) Force Development Evaluation (FDE) and post-operational Certification tests, such as the verification of technically compatible systems for Air-to-Air Refueling.^{12,13} While testing focused on national-systems could be tested in the context of a NATO environment, activities related to alliance interoperability will likely be preferred, due to the collective Return-On-Investment (ROI) of their accomplishment. The types of training in question are similarly restricted. The trade-space

under discussion is only relevant for the final mission certification or readiness exercises of otherwise fully qualified personnel. In other words, the operational exercise.

Why is Macro-efficiency not a Default Answer?

So, why do organizations within the same service, government, or at least industry, not pursue collective performance as a default? This phenomenon is largely a function of how their performance is measured. The training and testing communities have different policies, priorities, and measures of success. Further, the resource streams for these activities are, at least for the US military, separately budgeted and managed. As a result, both communities have developed specialized processes and procedures to internally satisfy their requirements in accordance with the criteria by which they are judged. Shifting the focus of their optimization efforts to a higher level may be contrary to the performance incentive system.

The policies that define training requirements, procedures, and practices can be traced from individual career-field guidance, e.g. pilots, up through the National Defense Strategy (NDS). The Department of Defense (DoD) uses a process known as Global Force Management (GFM) to assign and assess forces to the Combatant Commands (COCOMs) to fulfill their warfighting mission. The foundation of this process is the assessment of the readiness of forces to fulfill those requirements.¹⁴ Training is a measured aspect of readiness at all organizational levels throughout the process. The Chairman of the Joint Chiefs of Staff (CJCS) provides guidance and policy for training, which flows down through various implementation directives and policy documents to the services.¹⁵ For the USAF, the capstone policy directive for readiness is AFPD 10-2 Readiness, with an emphasis on reporting.¹⁶ Operational organizations are measured against both baseline standards and each other. This combination of preparing for

warfighting with performance openly published within the service and joint community means that readiness and training are only prioritized below actual mission execution.

In comparison to the primacy of training, testing is just one component of a subordinate priority of equipping the force. While testing will ultimately lead to the fielding of new or improved equipment, which will eventually enhance a unit's capabilities, any time or resources diverted to this objective potentially comes at the expense of readiness. Since readiness is both a higher priority and the measure of success for operational units, there are few near-term incentives to supporting integrated testing activities. Additionally, there is no logical upper limit on training resource requirements. Training can and will consume all time and resources allocated to it. This creates challenges for integrating testing and training events. Training events completed are significantly more valuable to trainers than test events completed.

The policy and guidance for military testing can also trace a path to the National Defense Strategy. However, it is constructed along functional, rather than command, lines and is oriented towards executive decision-making, rather than force presentation. The top-level document that establishes policy, processes, and measures of success for testing is the Department of Defense Instruction (DODI) 5000.02, "Operation of the Defense Acquisition System", under the authority of the Secretary of Defense.¹⁷ While testers are independent from the development and procurement centers, they are still part of the acquisitions community and are governed by the overarching guidance of DODI 5000.01, which directs a Total Systems approach, which balances system performance, operational effectiveness and suitability, survivability, safety, and affordability.¹⁸ As a result, the measure of success of a test is whether it was rigorous and complete enough to accurately assess the system and inform decision-making.

Testing then, like the larger acquisitions process, is about balancing time and resources against a myriad of specific test objectives in order to ensure that the most effective test possible is conducted. The key objective during test design is well paraphrased from the Air Force Operational Test and Evaluation AFOTEC Manual, “to ensure an operationally and technically adequate, credible and sufficient test where limitations and mitigation plans are clearly identified.”¹⁹ So, while the basic policy of testing calls for balancing, versus strict prioritization, the execution of the test, as designed, is a tester’s ultimate objective.

However, the test community faces a significant barrier to integrated activities that arises from the methods of testing, rather than policy. The scientific nature of testing, and the need to know what was measured, leads testers to conduct progressive, controlled events that build in complexity after verifying the preceding foundational steps. This accomplishes two important tasks. First, it manages the risks to personnel and material. Second, it helps to isolate the specific conditions and causes of any failures that occur. The tools and theory of testing revolve around concepts such a Design of Experiment (DOE), which focus on optimizing test efficiency and effectiveness with limited test runs.²⁰ The result of these processes is a highly optimized test plan that minimizes the duration, and consequently the cost, of a test while simultaneously maintaining a controlled and safe test environment. Consequently, it is the de-optimization of the test process and the associated loss of control of the test environment that pose the greatest challenge to integrated testing.

In addition to the difference in culture and priorities that are shaped by policy, there is a higher-order challenge to collective efficiency within military establishments, which is one of the features that distinguishes military organizations from commercial ones. The interactions between military organizations are dictated by priorities, rather than contractual agreements.

Each commander is responsible and accountable for the execution of his or her missions in order of their importance. The need to fulfill these obligations exceeds the requirements to honor previous commitments or external agreements. Any memorandums of Agreement (MOAs) that are signed by operational agencies will usually include a higher-priority exception clause to the support that they are committing to provide. But, even if it were not, an operational commander who breaks an agreement to support a testing activity due to higher operational priorities will not be censured by their superiors in any way because they would be acting in accordance with the larger institution's values. The impact to the test community is, quite literally, not their problem. So, while the concept of military priority is itself rational and acceptable, it is an impediment to integrated testing.

This poses a serious challenge to those considering collective efficiency and effectiveness. While service members may trust each other with their lives, service agencies don't trust each other with their money. There is significant historical evidence to support this distrust. In the US Air Force, fluctuation in fuel prices can create major "bills" during a fiscal year (FY), which must be paid for from within the service. In FY12, the USAF faced a \$1.3 billion funding shortfall for fuel, due to price increases. For perspective, that equates to about a \$1.00 per barrel difference in the price of oil.²¹ The Air Force has limited options for mitigating this type of expense: fly-less, repurpose O&M funds, or move money from investment accounts. In order to fulfill operational requirements, the bulk of this bill was paid for from multi-year investment accounts, i.e. development and procurement funds. By the same token, maintaining readiness continues to be a top priority. As the Air Force Chief of Staff, General Mark Welsh stated in regards to the FY14 budget, "Any relief in the FY14 budget will go into Readiness.

Readiness, it's at the top of our payback list.”²² So, the testing community is constantly at risk of losing support or pooled funds to the higher-prioritization of the operational community.

The lynchpin to moving forward in this area is higher-level prioritization of the integrated event. Within military hierarchies, or even international bodies such as NATO, there are priority-setting bodies that can protect the execution of integrated efforts from changing circumstances and ensure that resources will be retained to their original purposes if the events are disrupted. It requires a very high-level of staff coordination to accomplish this, because the testing and training chains-of-command are generally segregated until the highest levels of defense establishments.

While the challenges of culture, policies, and priorities between these two communities frequently inhibit close cooperation, there is precedence for an alternative approach. The foundation of one alternative is found within the framework of defense contracting. Of course, applying this approach requires the reimagining of the operational decision-making process as a contracting process.

The operational community generally approaches problem-solving by considering requirements, then balancing priorities and risks. The apportionment of forces or levels-of-effort that are assigned to achieve any particular objective is the product of the minimum effort required to accomplish the mission, modified by the commander’s tolerance for risk, and the demands of competing priorities. For operational missions, planners will not generally consider monetary costs. However, training activities typically are capped by a maximum monetary expenditure. But, the planning-problem is usually framed as an optimization problem, i.e. maximizing the number and priority of training objectives that can be accomplished with the available resources. This approach is analogous to the contracting source-selection process

known as Lowest-Priced Technically Acceptable (LPTA). This is the classic government approach of going with the lowest bidder.

An alternative approach, which has been formally documented and implemented for contract source-selection, is known as the Trade-off Method for achieving best value. These source-selections are commonly referred to simply as “Best Value.” A Best Value award allows the Source Selection Authority (SSA) to make tradeoffs between technical performance and other considerations, against price. This allows the SSA to select the best overall value to the government, rather than selecting the lowest-priced option that fulfills the minimum requirements.²³ This model establishes a framework for planners to consider the value of a longer training period, versus the total cost of an event.

Decision-Support Model

Armed with an understanding of the challenges and a construct for explaining an alternative approach, it is now possible to propose a decision-support model for capturing the value of integrated testing and training events that is both informative and streamlined enough for use by the Staff Officers that drive executive decision-making in military hierarchies. This model will address a series of questions. The first key question is related to testing conditions. Can the test be accomplished outside of the exercise’s events or does it require conditions that only exist in the midst of the exercise’s activities? If the test must be conducted within the context of the larger training event, how disruptive is it? In other words, what are the opportunity costs of conducting integrated testing and training? The second key question is related to monetary costs. What are the costs of deploying and sustaining the training and test assets, broken out with sufficient fidelity to allow the comparison of alternate scenarios? The final question is predicated on the answers to the first two. Can the inclusion of the test event

produce enough savings to “buy back” the opportunity and literal costs of fulfilling its requirements?

The first step in developing a decision model for merging testing and training events is to establish whether the activities are merely combined or truly integrated. This is an important distinction that leads to the subsequent questions regarding how disruptive the events are and the associated opportunity costs. Combined events will generally have greater planning flexibility than integrated events.

A combined testing/training event is one wherein the testing program can be completely deconflicted from the exercise events and merely requires access to personnel and equipment, in combination, at some point during the event. A combined testing/training activity can be accomplished prior to, in between, or after the exercise’s events are accomplished. For example, the certification of some military transport aircraft, requires that fully equipped paratroopers be timed while exiting the aircraft in a ground emergency scenario. This test could be accomplished on a non-interference basis within an exercise, even though it requires the dedicated use of the assets and personnel.

On the other hand, an integrated test event must be accomplished within the context of the larger exercise. If the test event were to be conducted as a stand-alone event, creating the relevant test environment would strongly resemble an exercise. For example, certifying the effectiveness of a communications data-bridge that connects multiple national and service platforms, under operational conditions, would require the same variety of assets and participants as a command and control exercise. It is the complexity of these events that actually creates the potential for return-on-investment.

If the testing and training activities must be integrated, then the second step is to determine how integrated they are. In today's highly integrated battlefield, particularly for NATO forces which rely on their integration and communications to be a force multiplier, it is easy to declare that everything is interconnected. This is true enough, but the degree of interconnection is critical for informing decision-making. Otherwise, it tempts commanders to oppose the imposition of test activities on their exercises and to attempt to bill the costs of the entire endeavor to the test agency. Meanwhile, the probability that the entire exercise will enter a holding pattern around the test is actually remote.

Conducting a top-level System-of-Systems Analysis (SOSA) will clarify and document which elements of the test and training forces are actually integrated and subsequently, how the shared costs of integrated or independent activities should be calculated. While SOSA may sound like an engineering or sciences methodology, it is a tool that is already in the military professional's toolbox. The US's Joint Operation Planning Process (JOPP) uses multiple iterations of SOSA in Operational Design. It is the foundation of the Political, Military, Economic, Social, Information, and Infrastructure (PMESII) analytical framework and Critical Factors Analysis.²⁴ The depth of JOPP processes also model appropriate limits for the depth of analysis that is required. These planning processes break down systems three steps away from their objective. This is consistent with Complexity Theory's assertions that one to two degrees of freedom is sufficient to predict system performance.²⁵ Therefore, this model proposes a three-tiered analysis of affected systems. This should enable test and exercise planners to conduct useful thought-experiments early on in the process to develop an understanding of the interactions between the elements of the activity prior to consideration of the additional friction.

The first tier-units for the SOSA are those that are directly involved in the testing activities. For example, in the CFI, aerial refueling certifications are a significant issue because the member nations have different processes and requirements for approving their aircraft to refuel from different platforms. In this scenario, the first tier operational units are the AR platform(s) and the receiving aircraft. For these first tier assets, the testers will likely need complete control of the asset and to dictate how it operates in order to maintain control of the “experiment” which is the test. If this is the case, then the full cost of these activities, in hours, should be levied against the test itself. However, if formal exercise objectives can be fulfilled by the testing activity, within its constraints, then the fractional costs of the activity should be pro-rated against the test. Conversely, the value of “simply flying” or “operating the system” should not be pro-rated.

The second tier units are the supporting and associated elements of the exercise that are actively, but not directly, involved in the immediate tasks and are required for the testing activity to be performed. This tier of SOSA will frequently be occupied by the Command and Control (C2) elements. In this case, principally airspace controllers and planners. These elements should be evaluated to determine if there are differential costs, compared to their normal operations. In other words, if an element performs its function regardless of the addition of the testing activities, its fractional costs should not be levied against the test for the decision space. For example, ground controllers operate 24/7 to control and deconflict airspace, whether there are any aircraft to control or not. On the other hand, if an airborne control asset has to be launched early to support the testing activity, its fractional costs should be considered.

The third and final tier of affected units are the down-stream assets that are affected only by the opportunity costs of lost training time associated with the testing activity. These costs

should initially be accounted for in training/flying hours, rather than monetary units, because the payback of the integrated testing is an extended training period, which will also initially be considered in time units. Figure 1 provides an example three-tier SOSA for air refueling certification testing in the context of a larger exercise.

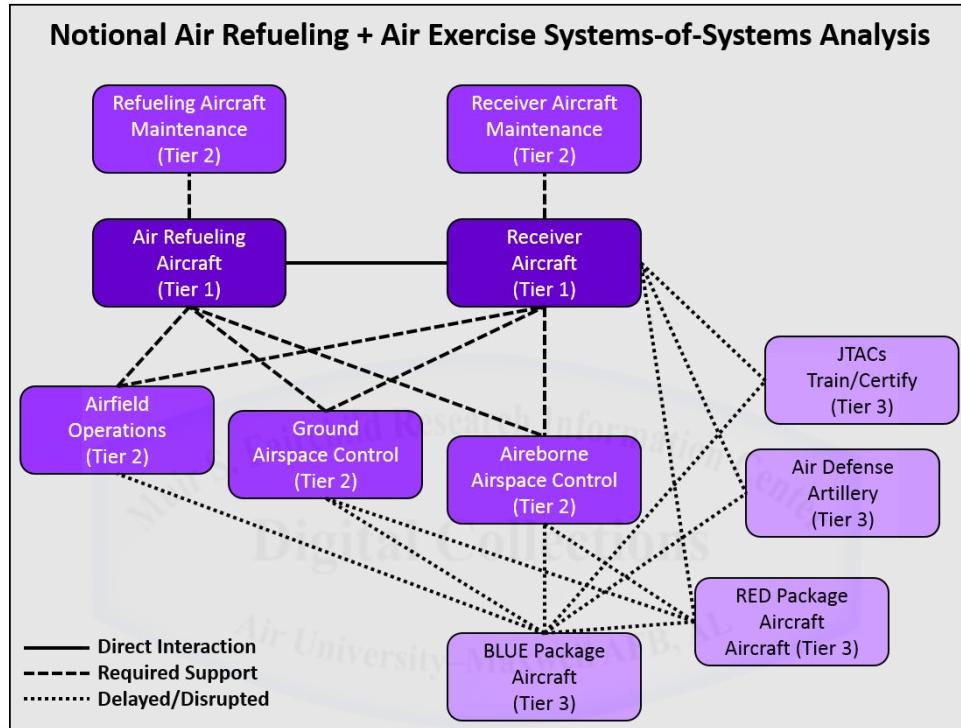


Figure 1. Air Refueling Certification SOSA

The SOSA analysis itself merely identifies the relevant components of the exercise that should be accounted for. The degree of disruption or delay experienced by each element must be quantified, as well as possible, and described in an accessible, narrative format. This phase will rely on the Staff Officer's understanding of the overall scheme of the exercise and consultation with the affected units and staff functionals to characterize the impact of injecting testing activities. Both the tester's requirements and the flexibility of the exercise plan must be well understood in order to assess and quantify the fractional impacts of the testing. Figure 2 is a notional example of an impacts roll-up table based upon the example SOSA. Once again, the

objective level of detail is that which is sufficient to inform strategic decision-making, not to identify completely accurate and precise impacts. As a result of the briefing-oriented decision-environment, the credibility of this type of information may rest more upon the accessibility and clarity of its presentation, than its completeness and rigor.²⁶

Notional Training Impacts of Supporting Integrated Testing		
Element	Tier	Impact
Air Refueling (AR) Aircraft (A/C)	I	Two (2) A/C require on-site instrumentation and 3.0 hours in contact with receiver aircraft, for 5 training days to conduct dry & wet certifications in NLT 0.5 hour increments. Contiguous days not required. A/C can be tasked for out-of-contact support.
Receiver Aircraft	I	Progressive, non-contiguous: 1-ship (2-days), 2-ship (2-days), and 4-ship (1-day) packages must be available, for 3.0 in contact hours per day in NLT 0.5 hour increments, same-sortie time-restricted training is taskable outside of contact hours.
Receiver Aircraft Maintenance	II	Additional Maintenance assets required for above-exercise turn rates for testing and training sorties.
Air Refueling Aircraft Maintenance	II	Priority of Mx over other assigned AR assets to ensure availability for testing
Airfield Operations	II	No impact relative to exercise operations
Ground Airspace Control	II	No impact relative to exercise operations
Airborne Airspace Control	II	Modification to orbit location to support testing activities, reduced high-intensity training time for controllers on supporting crew during sorties supporting testing.
BLUE Package Aircraft	III	Increased complexity to scheduling and routing, loss of potential for 1.5 hours per day of full-package training (after scheduling mitigations). Airspace restrictions in testing zone.
RED Package Aircraft	III	Extension of training day duration, no change training to hours/scenarios.
Air Defense Artillery	III	Extension of training day duration, no change training to hours/scenarios.
JTAC Training/Certification	III	Extension of training day duration, no change training to hours/scenarios.
Bottom Line Impact: Integrated testing increases daily scheduling complexity, extends the daily training period, reduce the potential for full-package training by 1.5 hours per day, and reduce training intensity for some elements.		

Figure 2. Notional Impacts of Testing on Training Environment from SOSA

With the impacts of integrating events in hand, the next step in the process of defining the cost-benefit space is to assess the financial cost of the activities. Unfortunately, one of the most difficult questions for a government agency to answer is “how much does it cost?” Many taxpayers find this frustrating and assume that this is due to the incompetency of the government bureaucracy. But, this is not necessarily the case. It is mostly the result of the scale and complexity of the services, personnel, and material that governments buy, which are not easily divisible or chargeable to a specific system, project, or individual. Rest assured, major companies have the exact same problem. To fully calculate the relevant costs for an integrated

testing and training event, known as Operations and Sustainment (O&S) costs, the participating agencies should use the Office of the Secretary of Defense (OSD) Cost Analyses and Improvement Group's (CAIG) level-2 Cost Element Structure (CES), provided in Figure 3.²⁷ Of course, at this level of accounting, the cost of this research paper is well over \$4,000. Its costs include the fractional time of the officer who wrote it, the government laptop it was written on, the cost of the bandwidth used during research, the instructor's time that was applied to the course, etc.



Figure 3. OSD Level-2 O&S Cost Breakout

Fortunately, it is not necessary to calculate the exact cost of the testing or training activities to inform the overall decision-making process. The only real question that needs to be answered is how much test funding can be freed by integrating the events and what can those funds buy that is useful to the exercise. Perhaps the most valuable resource to an exercise

planner is time. Ironically, this will frequently form the basis of arguments against integrated testing and training. Yet, it can be one of the easiest things for test funding to procure. If the operating costs and time-requirements to accomplish the testing and training activities are held constant, then marginal costs of moving assets for testing can be compared to the costs of extending personnel in place to increase the overall duration of the exercise.

Depending upon the specific scenario the source for costing data will vary. But, for the example air-refueling certification testing, the US government publishes the relevant information publicly. The focus on differential costs to support decision-making, rather than specific costs for direct accounting dramatically reduces the information that is required. The Under Secretary of Defense (Comptroller) publishes reimbursable rates for the use of fixed- and rotary-wing aircraft, military personnel, and other categories of assets that could potentially be used on a reimbursable basis by DoD, Federal, and non-government agencies.²⁸ Additionally, US Transportation Command (USTRANSCOM) publishes additional surface-, maritime-, and air-lift rates.²⁹ These rates are drawn from the same data-set and calculated in the same manner. They are also focused on the immediate operating costs of the platforms, not their long-term sustainment or total cost of ownership. These numbers are appropriate for considerations of short-term usage, which is the question at hand, rather than multi-year budgeting decisions. These rates will define the cost of moving assets for an independent test event, with all other testing costs held constant.

In order to calculate the potential benefit to the exercise, the basic cost of time for the event, not the costs of activities, must be determined. This will vary with the specific nature of the training event. However, since the personnel costs of active duty military and federal civilians are budgeted annually and centrally controlled, there is only an opportunity cost for

their time, rather than a specific billable cost related to the exercise. Instead, for a NATO exercise, the principal costs are those associated with dislocating personnel from their home stations to conduct the event. For the purposes of this decision-support tool, the transportation costs for both the testing and training team will be considered a sunk cost. The focus is on the daily rate of keeping personnel on site. The Government Service Agency (GSA) and the State Department maintain world-wide rates for lodging, meals, expenses, and incidentals which will characterize the cost of living on the local economy as a visitor and are centrally accessible via the Defense Travel Organizations.³⁰

For the example scenario, re-positioning two air refueling assets from the eastern coast of the United States to United States European Command (EUCOM) to conduct certification testing will require approximately 10 hours of flying time. The Test Director would likely include at least one day of set-up margin and an extra day for a make-up test-event, which will be charged at the USTRANSCOM Minimum Activity Rate (MAR). The actual flying hours for the test activities are not considered here, as they will be executed in either scenario. Additionally, the Test Director will be billed for the re-positioning flight to return the aircraft to its home base. This will cost around \$14,000 per flying hour and incur a \$28,000 per day MAR fee for the margin-days. This yields roughly \$672,000 in billable charges just to position primary and back-up Air Refueling assets. The VOQ Rates are roughly \$56.00 per night, assuming on-base lodging, and per-diem is roughly \$130.00 per day. At those rates, an integrated test can buy an additional 3,612 man-days of on-site time. Perhaps more accessibly, that buys a 1,200-person exercise, three extra days on location to conduct their activities.

The last step of this process is to finish translating the economic costs and benefits into training costs and benefits to match the priority driven decision-making construct of operational

commanders. In other words, what can the extra time do for the training command? In this case, it can enhance the effectiveness of the training by increasing the debriefing and review time between events, when it is most effective. It can add schedule margin for environmental conditions or issues, and create the opportunity to conduct other training that does not expend additional resources. Figure 4 presents the outputs of this model in one ubiquitous PowerPoint slide.

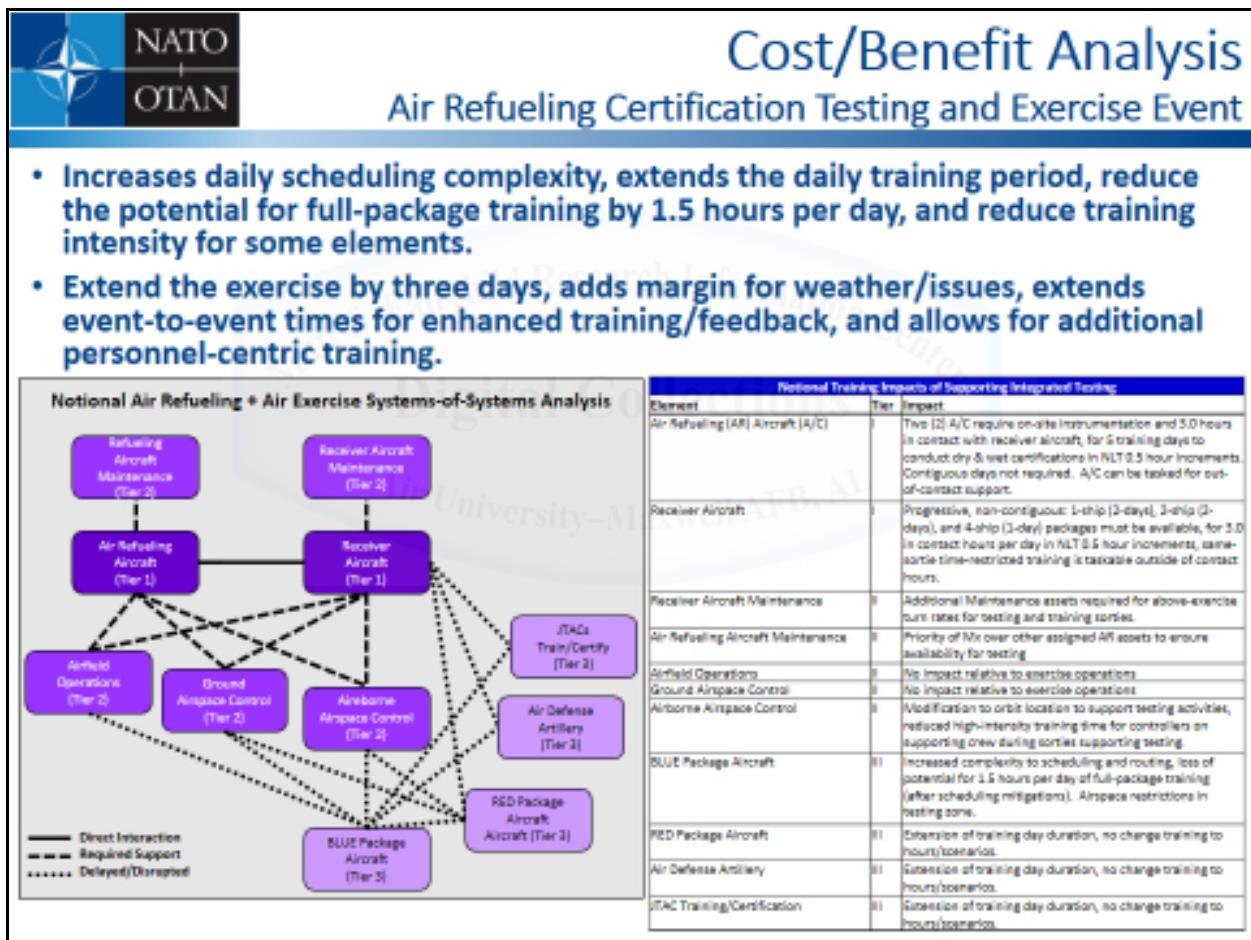


Figure 4. CBA Roll-up Slide

Conclusion

Efficiencies must be found in order for NATO forces to modernize and enhance their ability to function together, in the face of global economic challenges. Yet, while NATO as an

institution is well aware of the cultural differences between its member nations, it may be unaware of the cultural differences within the militaries themselves. As a result, significant opportunities for cross-domain efficiencies may go overlooked. This is particularly true between the testing and the training communities, which due to their function-centric views and differences in measures of success are inclined to form ineffective relationships. The key to bridging that gap is to frame decisions to conduct an integrated events in terms of costs and benefits that are relevant to the training command and highlight where those costs and benefits lie. Simple cost comparisons are an inadequate tool for the task. This paper has presented a decision-support model that applies a marginal-cost comparison approach to a System-of-Systems-Analysis (SOSA) to package costs and benefits into a value-judgment decision framework that should be within the comfortable skillset of a typical Staff Officer. This framework may ease the cross-community mistrust and enable NATO forces to achieve enhanced efficiency and effectiveness in the 21st century.

Endnotes

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